
5 Series sport wagon

INTRODUCTION

The 5 Series sport wagon is being introduced in the US market for Model Year 1999 (9/98 SOP). It shares many components with its E39 sedan counterpart and is identical from the "B" pillar forward.

US market 5 Series sport wagons are available in two variants:

- 528i sport wagon; powered by the recently introduced 2.8 liter M52 TU engine,
- 540i sport wagon; powered by the new 4.4 liter M62 TU engine.

Transmission availability includes:

- 528i - **Standard:** 5-speed manual (S5D 310Z), **Optional:** 4-speed automatic (A4S 270R).
- 540i - **Standard:** 5-speed automatic (A5S 440Z - Steptronic), **Optional:** None

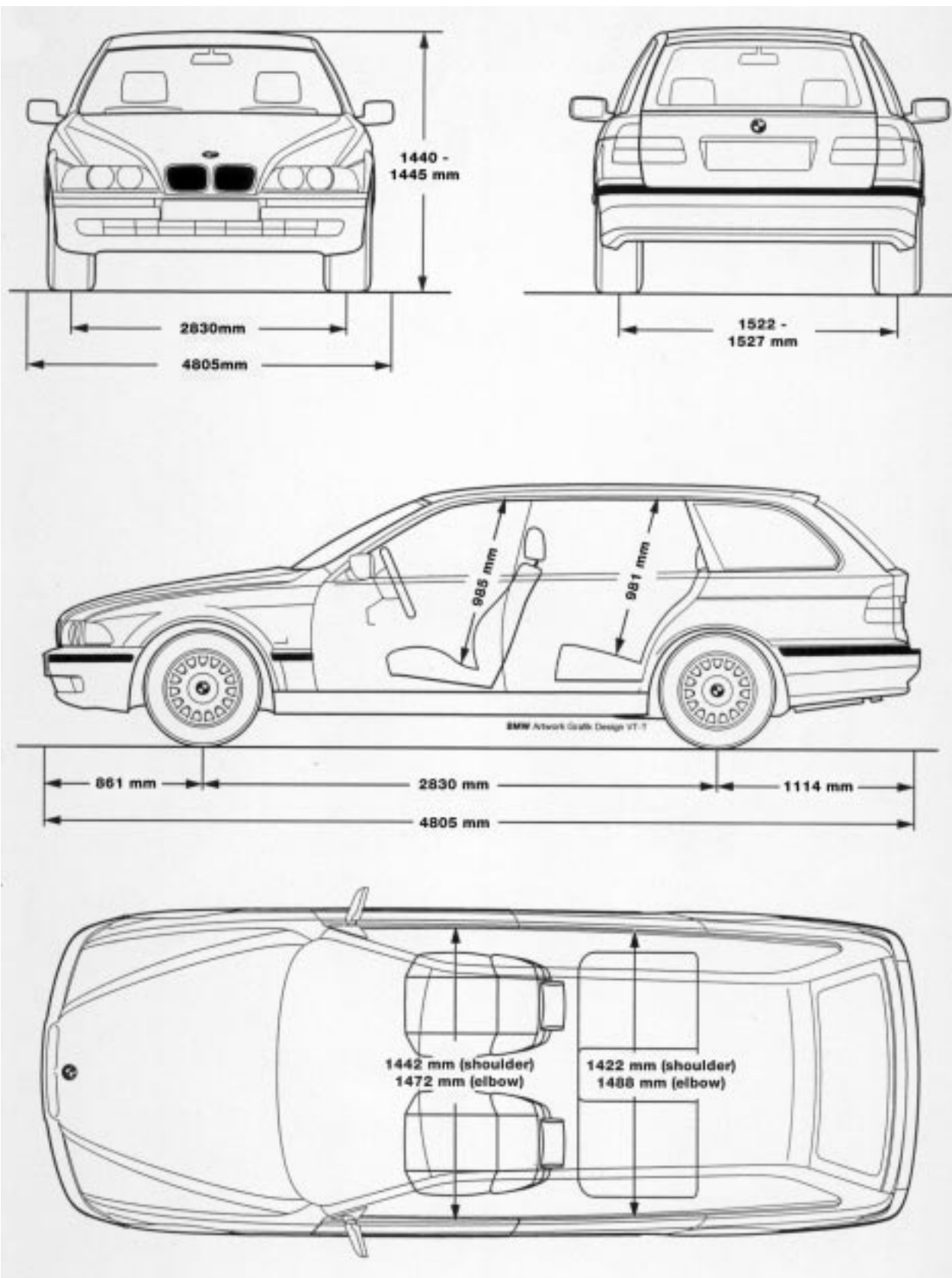
The E39 sport wagon tailgate is larger than its predecessors (E34 touring) with a lower sill for easier cargo loading.

The wheelbase of the sport wagon is the same as the sedan, however the body is 30mm longer and 10mm higher.

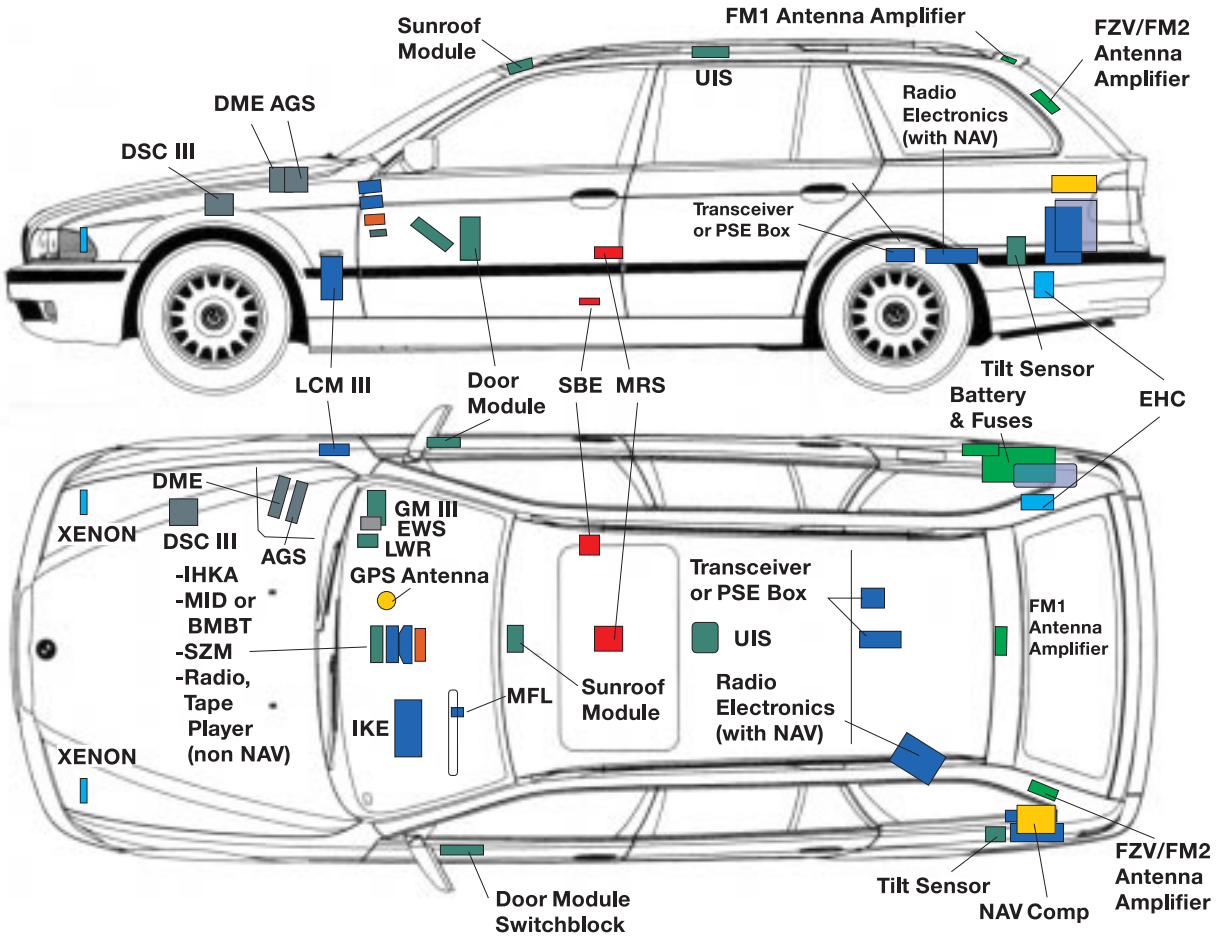
The design of the sport wagon rear suspension system is new. The system eliminates the upper rear spring strut mounting found on the E39 sedan models which increases the load space in the cargo area. The entire loading area of the sport wagon is a uniform width.

The rear suspension is also configured with a self-leveling air spring suspension system (EHC) which is optional on the 528i sport wagon and standard on the 540i sport wagon.



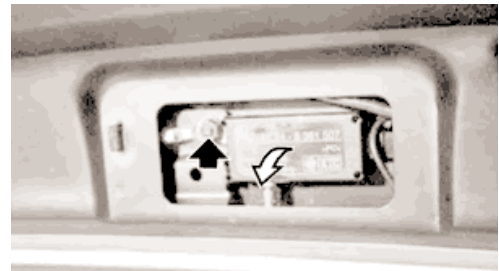
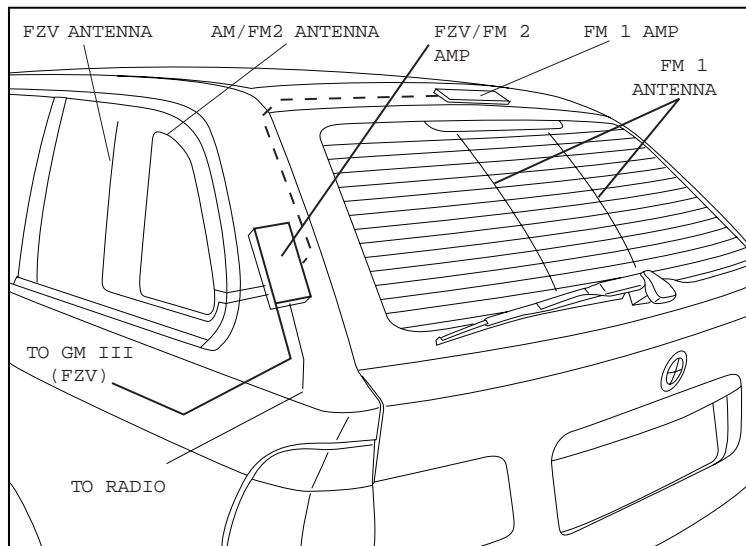


SPORT WAGON ELECTRONIC CONTROL MODULE LOCATIONS

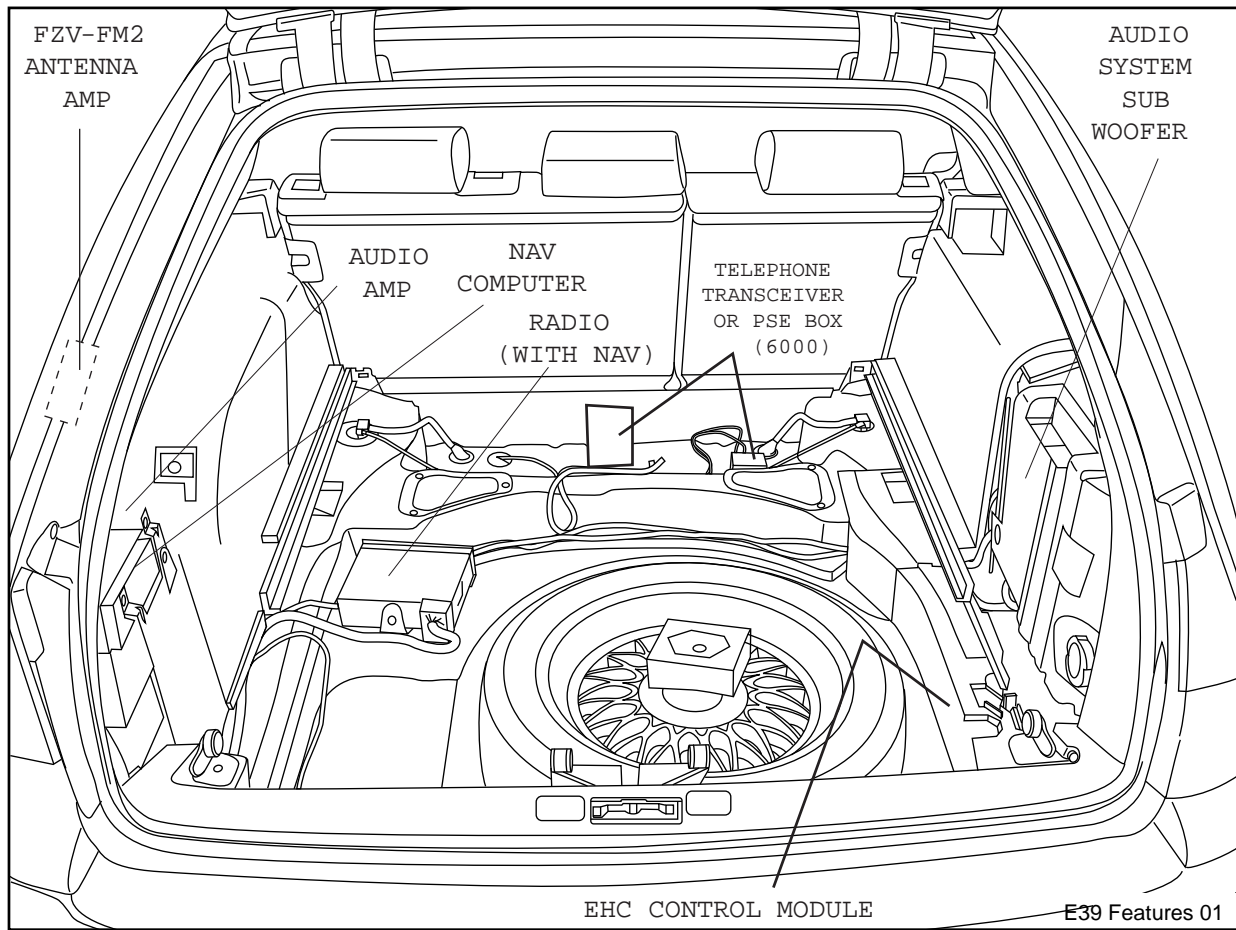


Sport Wagon Antenna Configuration

The antenna configuration is unique on the sport wagon. There are two diversity FM antenna amplifiers, FM1 amp is located in the rear window frame. Located in the left D pillar is the shared FM 2/FZV amp.



Refer to TIS repair manual for specific access and or R&R procedures for the sport wagon antenna components.



The rear side access panels drop to reveal the radio amplifier and CD changer on the left side and the sound system subwoofer on the right side. The subwoofer has a hold down knob and is mounted on a hinge. It can be swung out to access the battery and fuse panel by unscrewing the knob.

TAILGATE

The tailgate opens to an angle of 88° measured from the "D" pillar and to a height of 2029mm measured from the ground to the upper edge of the raised tailgate.

The rear window is bonded to a load bearing frame and can be opened separately from the main tailgate. This improves the overall rigidity of the tailgate assembly.

The tailgate gas springs are recessed into cavities in the roof. Special tools are required for removal. Refer to E39 sport wagon special tools on page 96.



TAILGATE LOCK SYSTEM

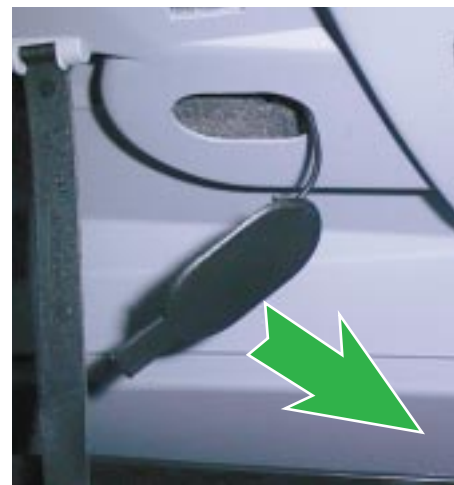
- The tailgate lock assembly is a combination of Soft Close Automatic (SCA) of the E38 and the tailgate lock mechanism from the E34.
- The electrical operation of the SCA is the same as on the E38 and is a function of the central body electronics.
- A mechanical tailgate lock cylinder is not used on the sport wagon. The door is opened by the unlock pad above the license plate, the remote tailgate switch located in the drivers kick panel or via FZV control.

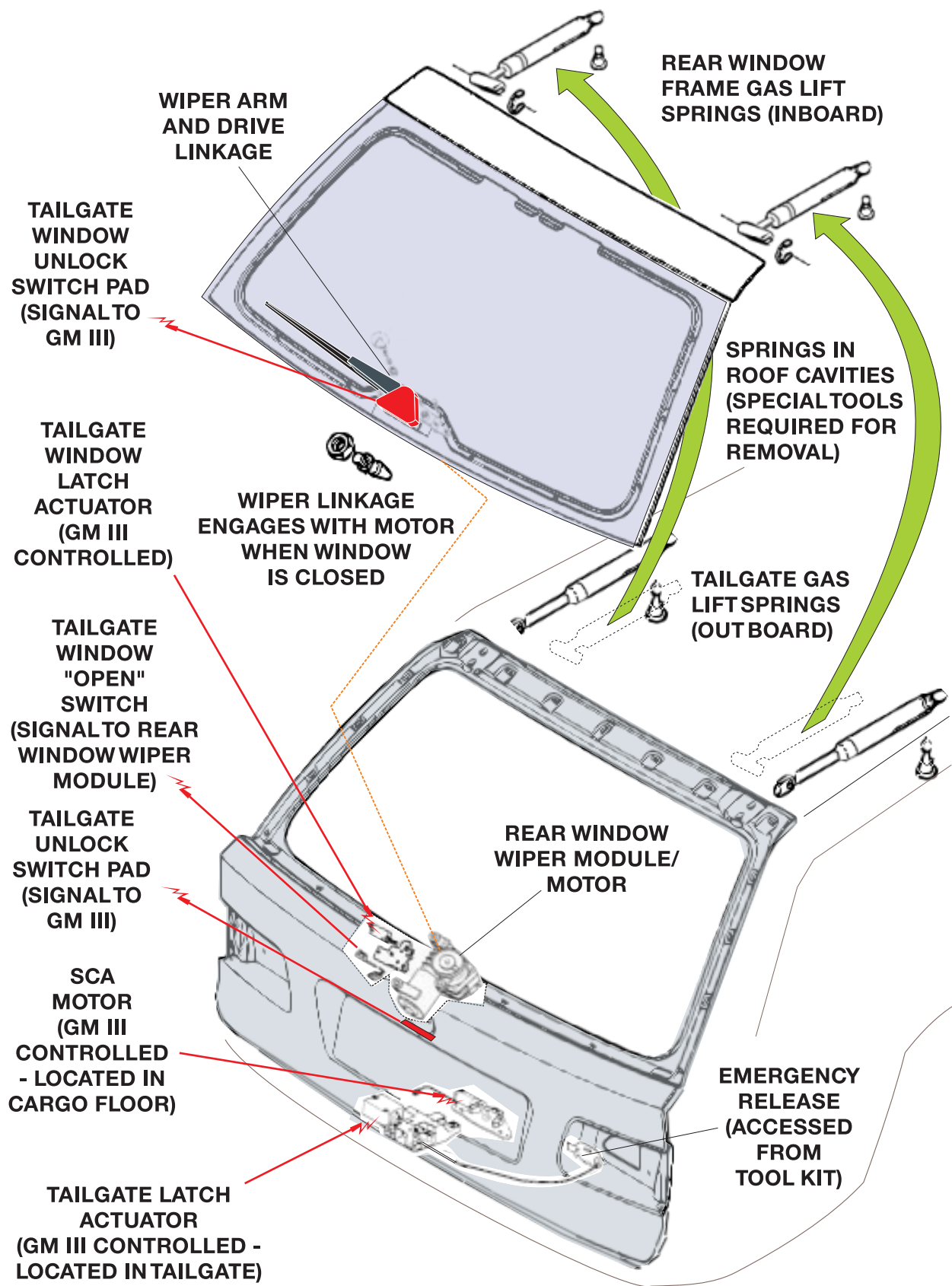
EMERGENCY RELEASE

An emergency release mechanism is however incorporated into the latch assembly to open the hatch from the vehicle interior if malfunctions occur.

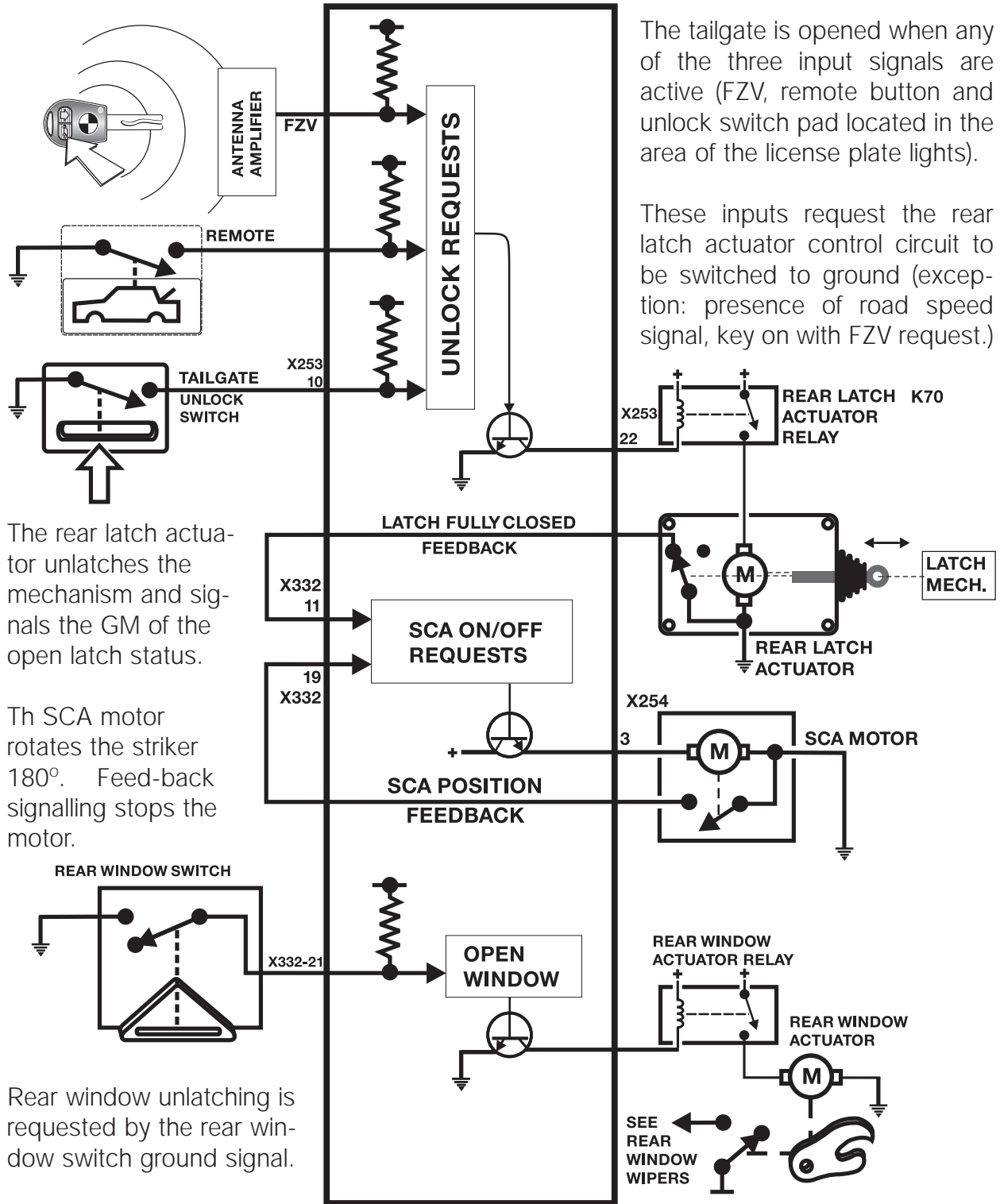
To access the emergency release, drop both side storage covers in the cargo area. Turn the tool kit release levers 90° to unlock tool kit from tailgate. Lift tool kit up and find the plastic tab on the passenger side.

Pull the tab from the tailgate and pull the connected plastic cable outward to the passenger side of the vehicle.





ZKE CONTROL OF TAILGATE AND WINDOW LATCHING SYSTEM



The tailgate is opened when any of the three input signals are active (FZV, remote button and unlock switch pad located in the area of the license plate lights).

These inputs request the rear latch actuator control circuit to be switched to ground (exception: presence of road speed signal, key on with FZV request.)

The rear latch actuator unlatches the mechanism and signals the GM of the open latch status.

The SCA motor rotates the striker 180°. Feedback signalling stops the motor.

Rear window unlatching is requested by the rear window switch ground signal.

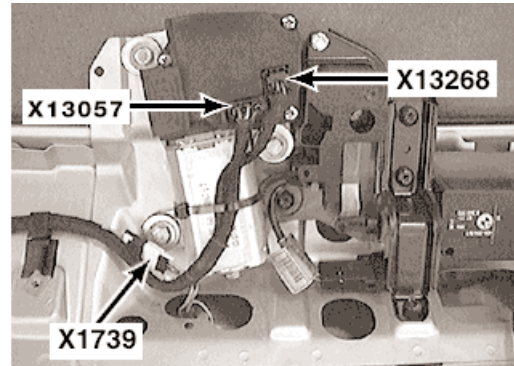
This signal initiates activation of the rear window actuator relay control circuit which activates the rear window actuator. The actuator unlatches the mechanism opening the window. The latch simultaneously provides an open window signal for the rear window wiper motor module as well as an interior light on request (via the wiper module).

REAR WINDOW WIPER/WASHER

The rear wiper system on the E39 Sport Wagon is a self-contained unit. The control electronics are integrated into the gear drive that is part of the motor assembly.

The control electronics contain two hall sensors, one for the park position and one for the end stop, or to signal reverse direction of the wiper motor.

- X13057 - KL 30, KL 31 & Washer Pump Control
- X13268 - KL R, Switch Inputs, GM/LCM interface
- X1739 - Tailgate Unlock Switch



The wiper arm drive shaft bearing, drive shaft and wiper arm are mounted to the rear glass, while the motor, control module and gear drive are mounted to the tailgate.

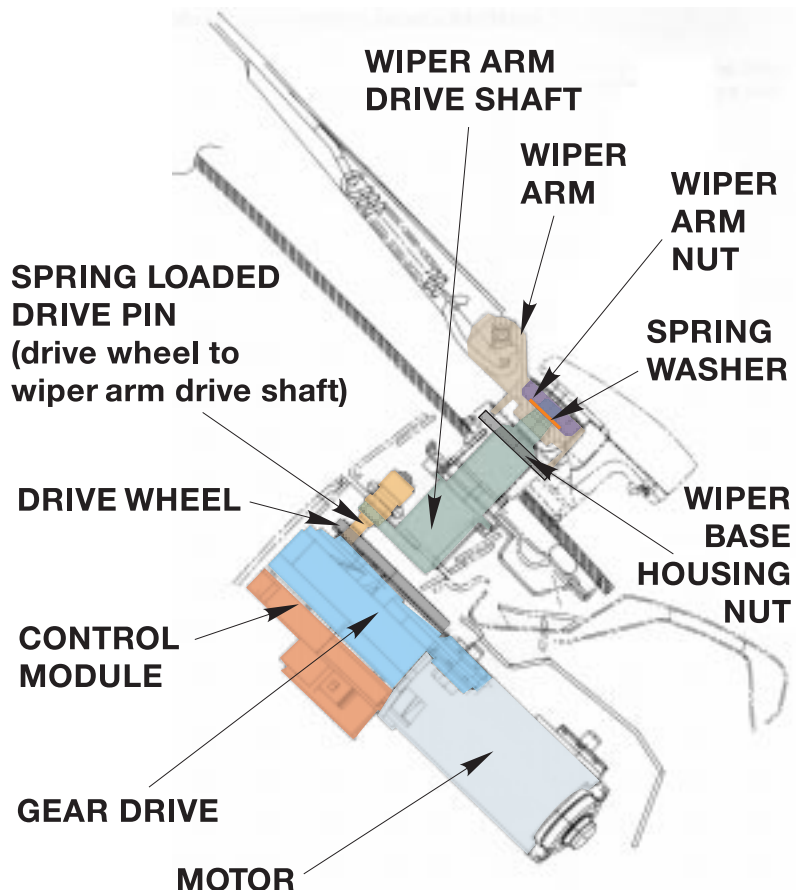
Rear Window/Wiper Service Notes:

- When replacing a rear window make sure the wiper base mounting nut is tightened to specification shortly after the window is placed on the rear window frame.

This will secure the glass at the base of the window frame ensuring a good seal before the bonding adhesive dries.

- The wiper arm and drive shaft are connected by splines. Special tool 61 1 320 is required to hold the drive shaft in park position prior to installing the wiper arm on to the drive shaft.

Refer to E39 sport wagon special tools on page 104.



REAR WIPER/WASHER OPERATION

The rear wiper is operator controlled through the stalk switch on the steering column. The switch includes the following added functions:

- Intermittent rear window wiping
- Programmed rear window wiping interval
- Operation of the rear window washer

Additionally, the system automatically controls the following safety and convenience features.

- Wiper interrupt with the rear glass opened
- Wiping interrupt with a blocked wiper arm
- Continuous wiping when the vehicle is shifted into reverse.



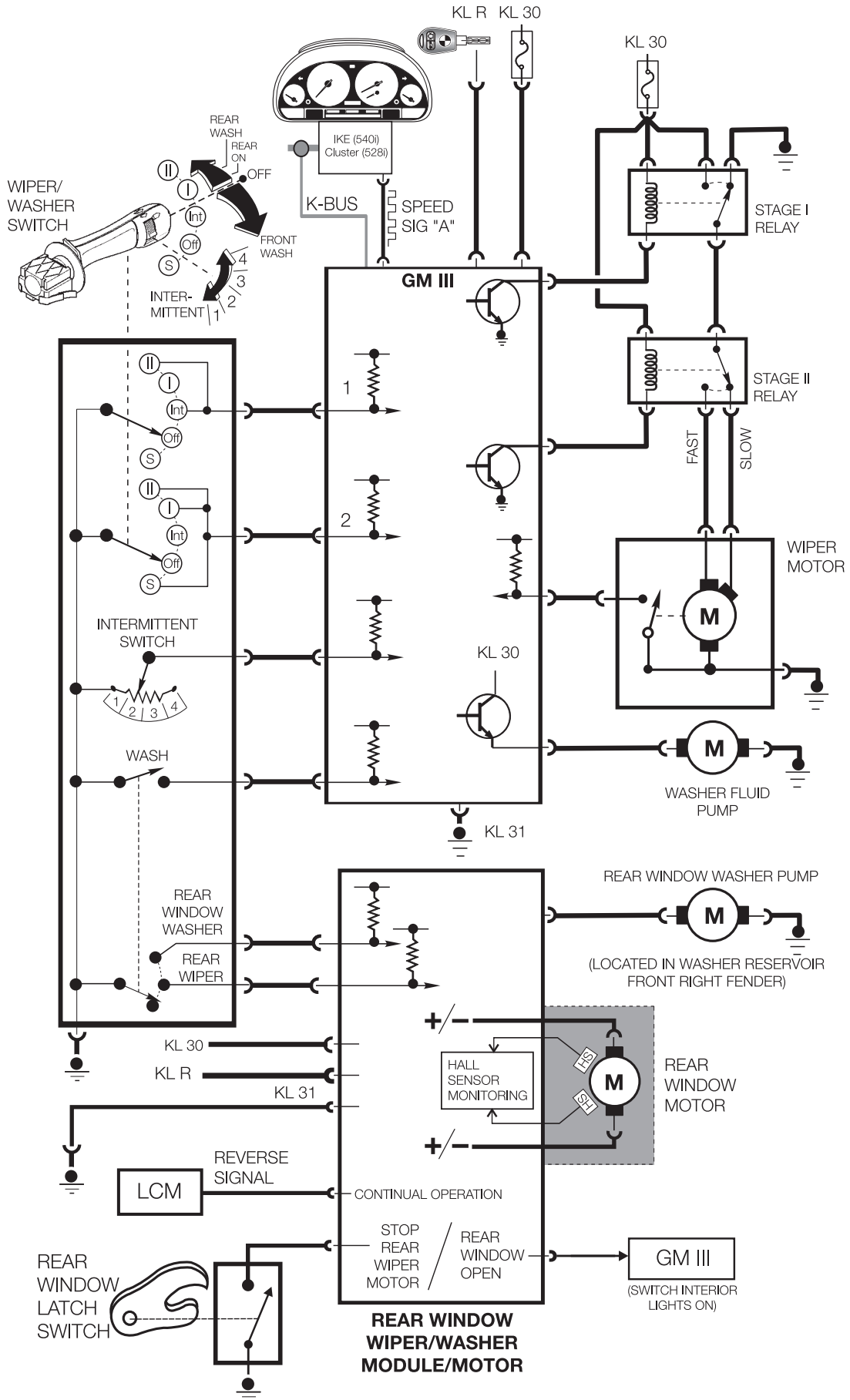
Pressing the wiper stalk forward to the first detent activates the rear wiper in the intermittent mode. The timed interval is approx. 7 seconds. The full sweep and park positions are recognized by the two hall sensors on the motor gear assembly. If the wiper is switched OFF, the wiper blade will return to the park position.

If the transmission is shifted into reverse, the wiper will switch to continuous operation until the vehicle is shifted out of reverse.

The programmed wiper interval procedure is as follows:

- Briefly switch the rear wiper ON/OFF
- Wait the desired interval time
- Switch the rear wiper ON again
- The OFF time will be the programmed interval - up to approx. 30 seconds

Rear window washing is activated by pressing the wiper stalk switch to the full forward position. The washer pump operates followed by two full wiping cycles. The wipers will then switch to the intermittent wiping mode.

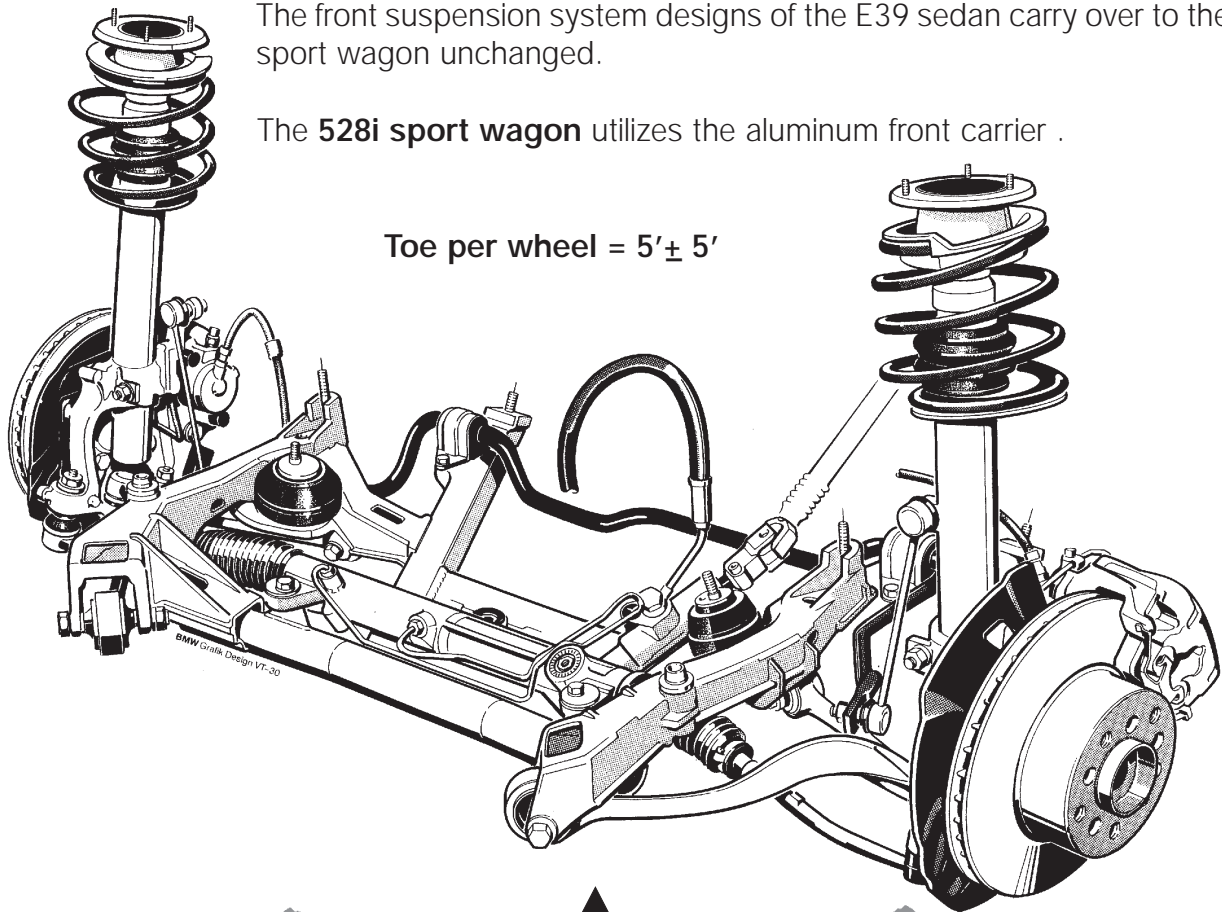


SPORT WAGON SUSPENSION SYSTEMS

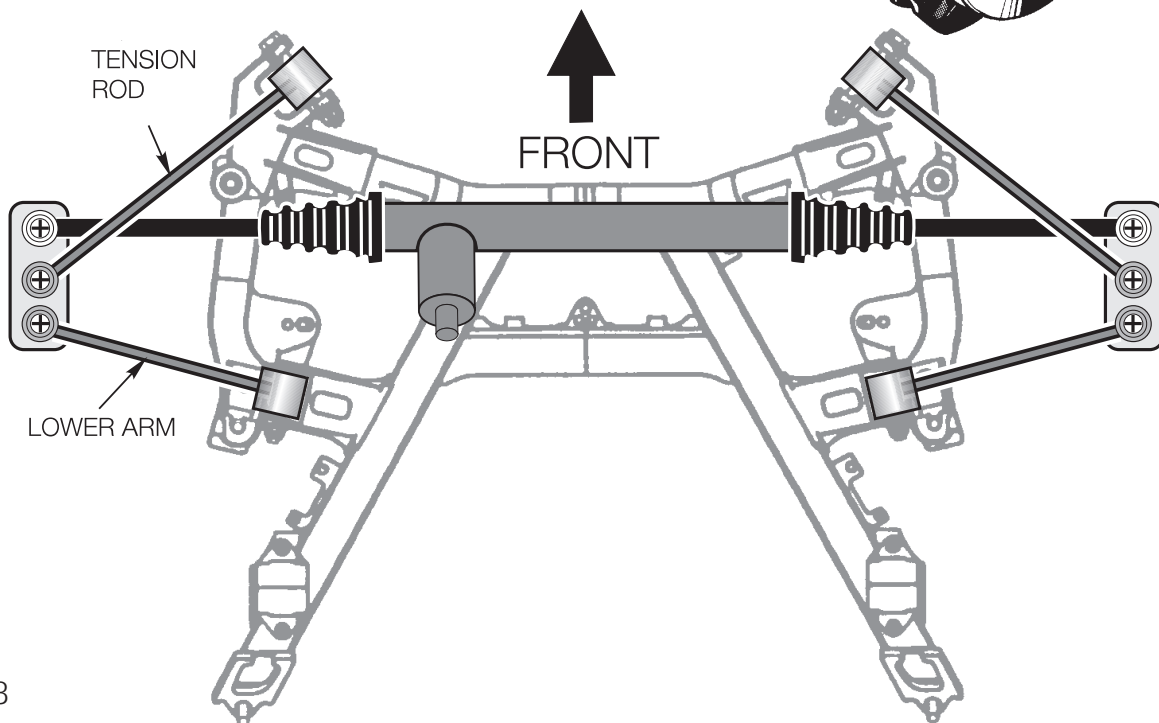
FRONT SUSPENSION SYSTEMS

The front suspension system designs of the E39 sedan carry over to the sport wagon unchanged.

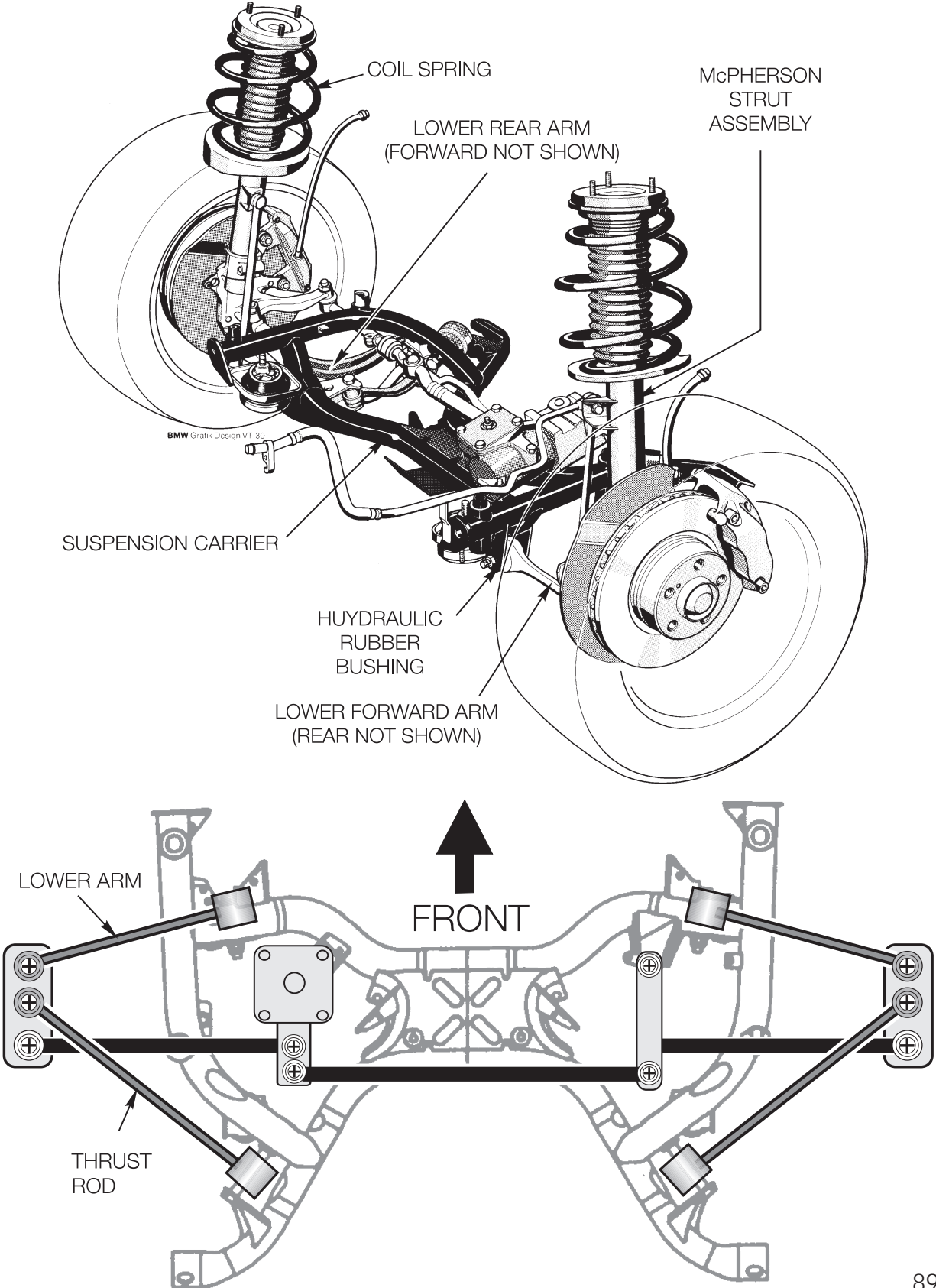
The 528i sport wagon utilizes the aluminum front carrier .



Toe per wheel = $5' \pm 5'$

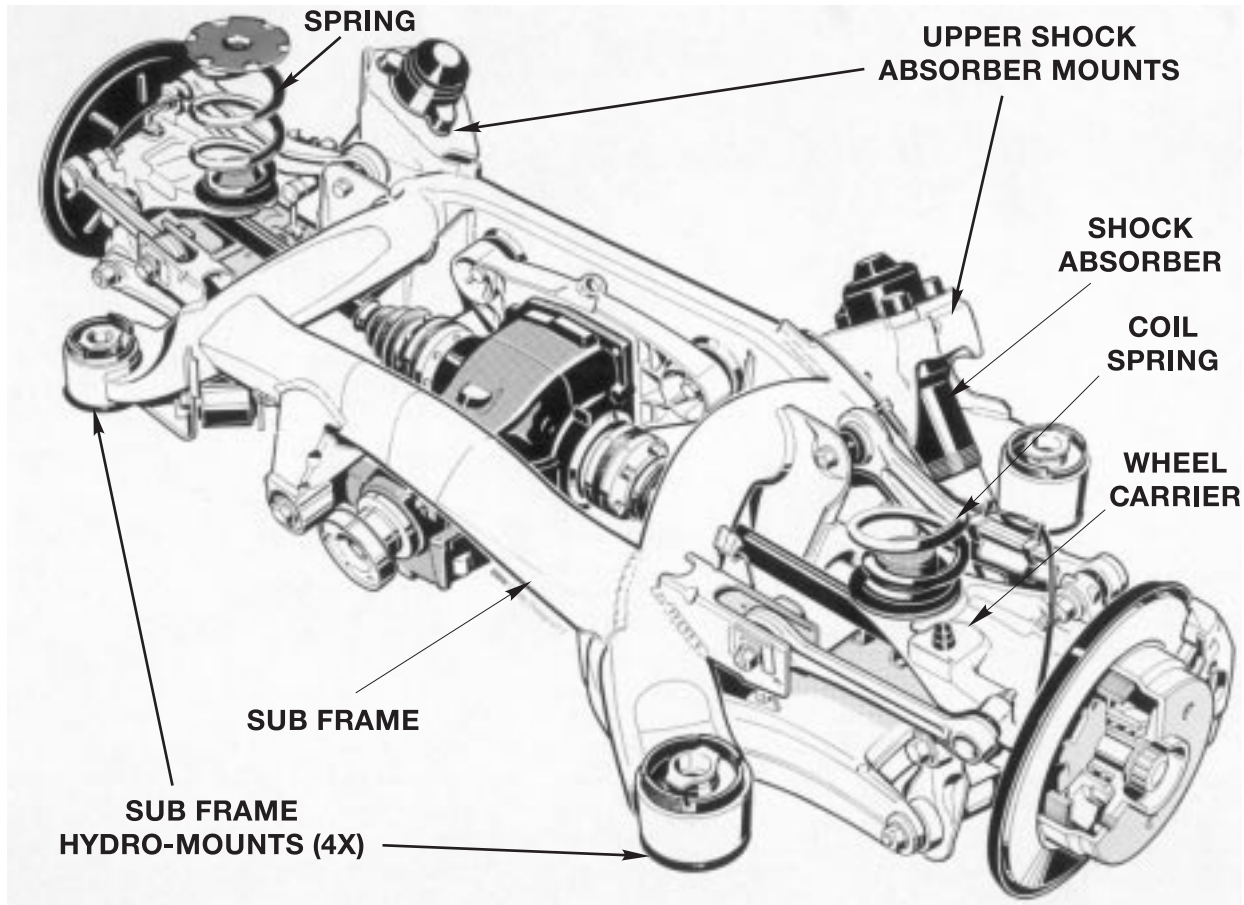


The 540i sport wagon uses the same tubular steel carrier front suspension found on the 540i sedan.



REAR SUSPENSION SYSTEMS

The standard rear suspension of the 528i sport wagon follows the design characteristics of the four link elasto kinematic system of the E38/E39 sedan vehicles.



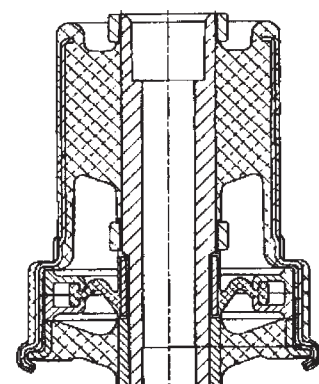
The main design difference is the separation of the coil springs and dampers.

- The coil springs are positioned between the perches of the wheel carriers and the underside of the rear floor pan.
- The shock absorbers are positioned diagonally between the lower lateral control arm and the rear axle sub frame.

This configuration provides the wide, uniform load space in the cargo area.

Since the shock absorbers are now mounted directly to the sub frame, the sport wagon requires unique sub frame **hydro mounts**. The hydro mounts contain a fluid that helps to suppress road/suspension noise and vibrations from transmitting into the vehicle body.

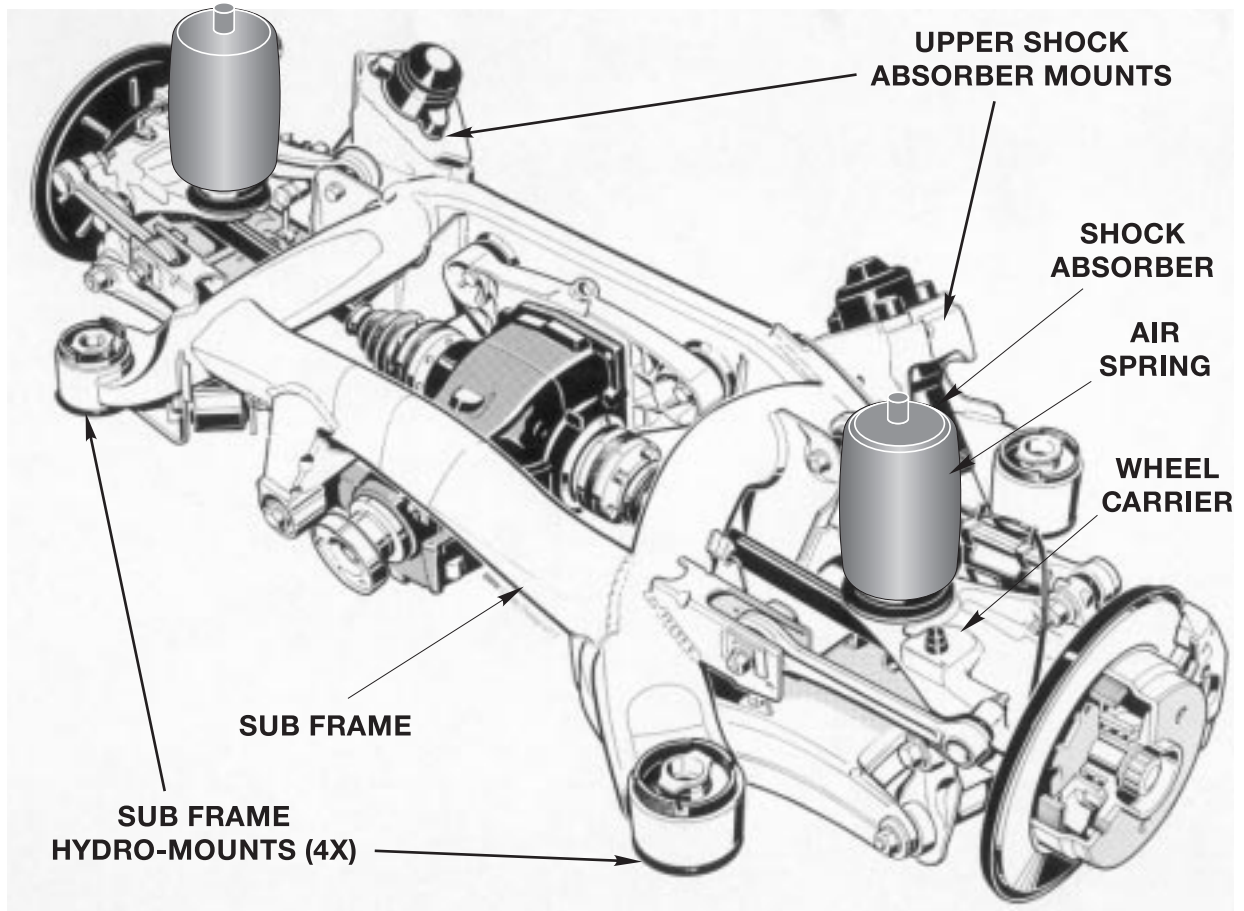
The hydro mounts require new special tools for removal and replacement. See E39 sport wagon special tools section on page 96.



ELECTRONIC HEIGHT CONTROL (EHC) AIR SUSPENSION SYSTEM

OVERVIEW

The self-leveling air suspension system is being introduced on US market E39 sport wagon vehicles. The system is standard on the 540i and optional on the 528i sport wagons.



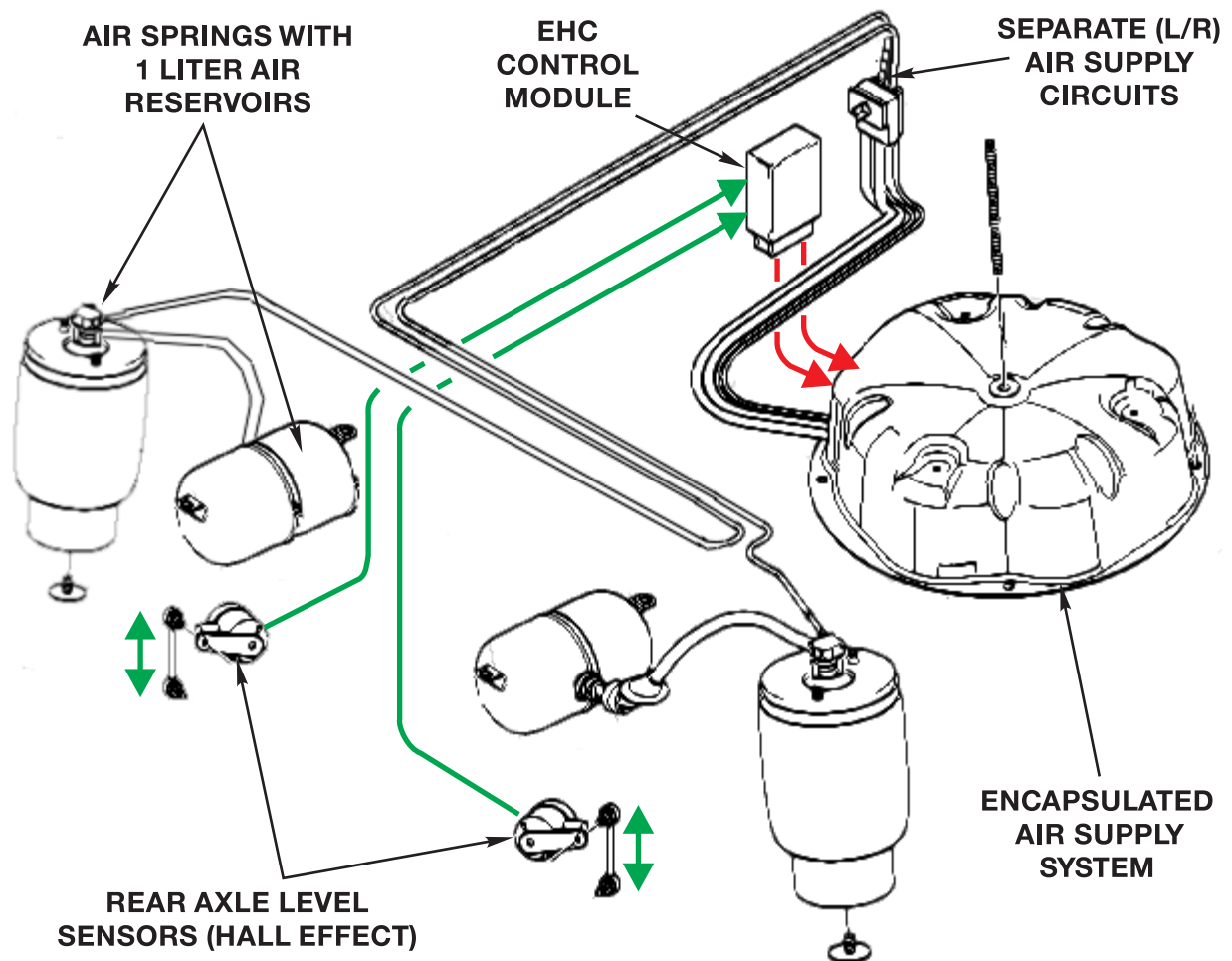
The mechanical design is identical to the standard 528i rear suspension however the coil springs are replaced by air cushion springs. The air pressure in the air springs is managed by the EHC system which automatically controls the ride height under all operating conditions.

OVERVIEW OF EHC CONTROL SYSTEM

The control philosophy of EHC is to "Initiate a control sequence only when necessary". The system offers the following advantages:

- The control system operates independently from the vehicle's engine (no engine driven hydraulic pump system as per previous self leveling systems).
- Individual control of the rear wheels is possible
- An uneven load is identified and compensated for
- Uneven road surfaces are identified and not compensated for
- Automatic control is interrupted when cornering
- The system is diagnosable using the DIS or MoDiC

The air suspension system consists of the following components:



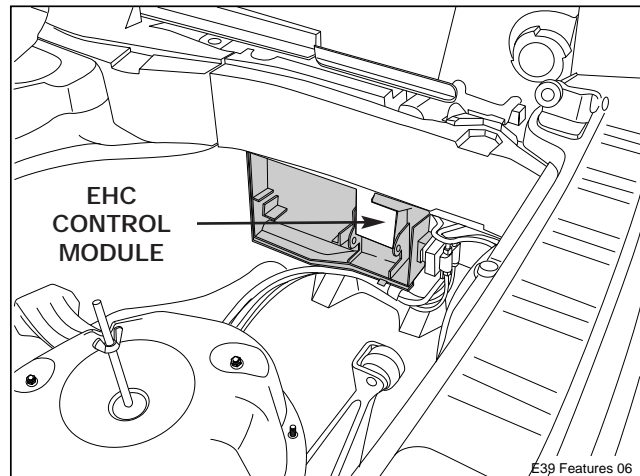
EHC SYSTEM COMPONENTS

CONTROL MODULE

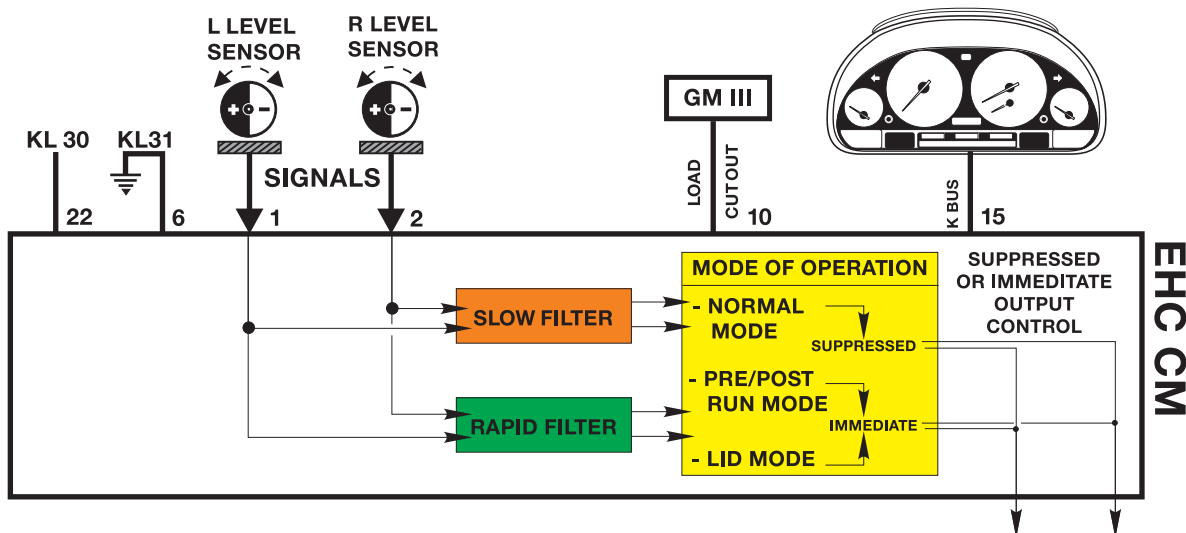
The Control Module is mounted in the module carrier box in the luggage compartment on the right side. It contains the processing electronics and final stages for operation of the EHC system.

The control module receives the following inputs for its processing functions:

- KL 30 & 31 (Power/Ground)
- KL 15
- Left & Right Ride Height Sensors
- K Bus for;
 - Vehicle speed
 - Engine running
 - Door/tailgate - open/closed



The control module incorporates two filters (slow/rapid) for processing the input signals from the ride height sensors. Depending on the operating mode, either the slow or rapid filter is used to check the need for a regulating sequence.



The slow filter is used during the normal operation mode to prevent normal suspension travel from causing the system to make adjustments.

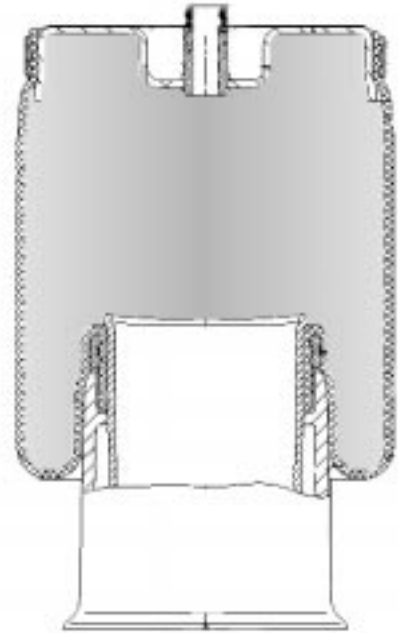
The rapid filter is used during the pre-run and tailgate (LID) modes to ensure that the suspension is adjusted quickly while the vehicle is being loaded or checked prior to operation.

AIR SPRINGS

The air spring is made from a flexible rubber material. It forms an air tight cavity which provides the calculated spring rate required for the sport wagon.

As the spring compresses downward the bottom edge of the rubber material rolls along the vertical surface of the base mount cylinder.

Air is added or removed from the air spring through its top port. The top port of each spring is connected to a reservoir and the air supply pipes. The reservoirs are required to hold additional air due to the compact design of the springs.

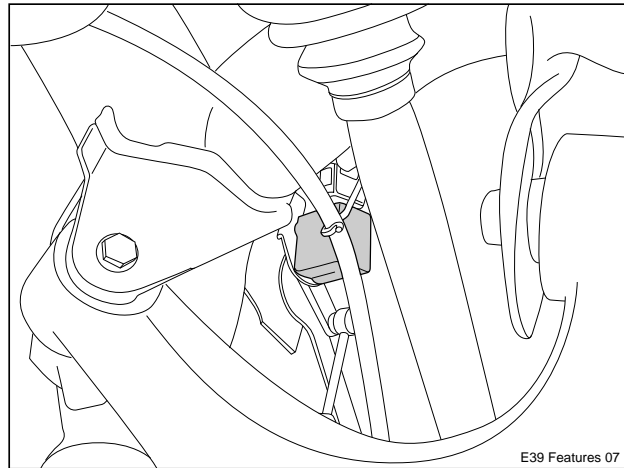


REAR AXLE LEVEL SENSORS

Hall effect sensors are mounted on the left and right sides of the rear suspension for ride height detection. They are pivoted by a coupling rod through the rear axle swing arms.

The hall sensors produce a varying voltage input to the control module as the suspension height changes.

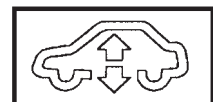
If the vehicle is equipped with Xenon headlights the right side sensor contains an additional sensor for the automatic headlight level adjustment system.



WARNING DISPLAYS

If the system is faulted and off-line or set in the transport mode, the following is displayed:

Basic Cluster: A warning lamp indicator is illuminated used on the basic cluster.



High Cluster: A message is posted in the high cluster matrix display.

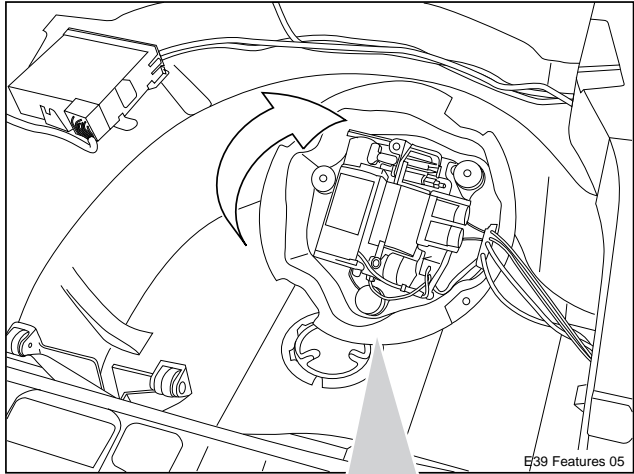


AIR SUPPLY SYSTEM (LVA)

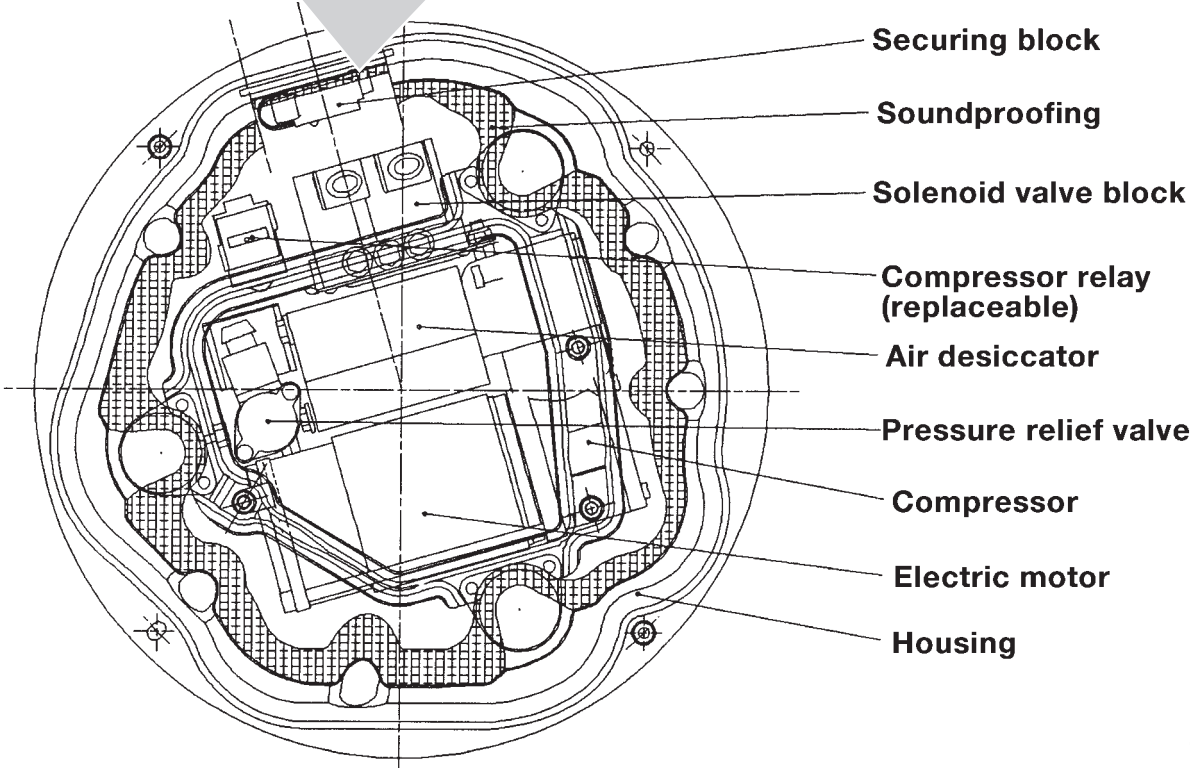
The air supply system is identified as the LVA in the diagnosis program and in the repair manual. It is mounted in the spare tire well compartment. The components are housed in a sound deadening carrier, through rubber bushings, to prevent operating noises from being transmitted through the vehicle's interior.

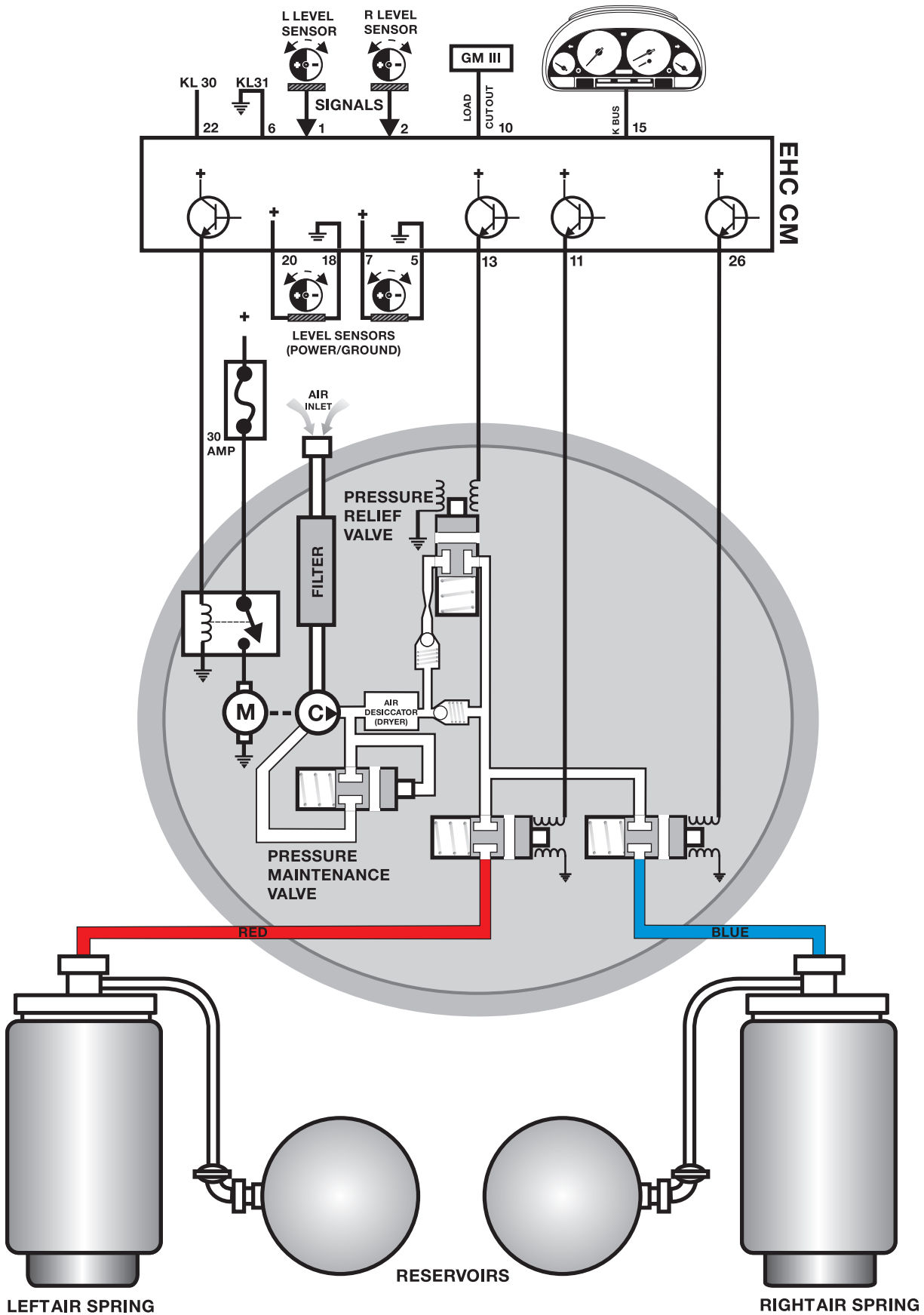
With the exception of the compressor relay, individual replacement parts for the air supply system are not available. If diagnosis determines a defect in any of the other air system components, complete replacement is necessary.

The air supply system consists of the following components:



- Compressor assembly with;
 - Piston compressor
 - Electric motor
 - Air dryer (desiccator)
 - Pressure relief solenoid valve
 - Pressure maintenance valve
 - Check valves
- Compressor Relay (Replaceable)
- Solenoid Valve Block (2 - two way valves)
- Lines - including distributor block





EHC SYSTEM OPERATION

A fully functional EHC system is controlled by one of three different modes of operation. The operation mode is selected by the control module based on current conditions provided by the monitored input signals. The main modes of operation are:

- **Pre-Run/Post-Run Mode**
- **Normal Mode**
- **Tailgate Mode**

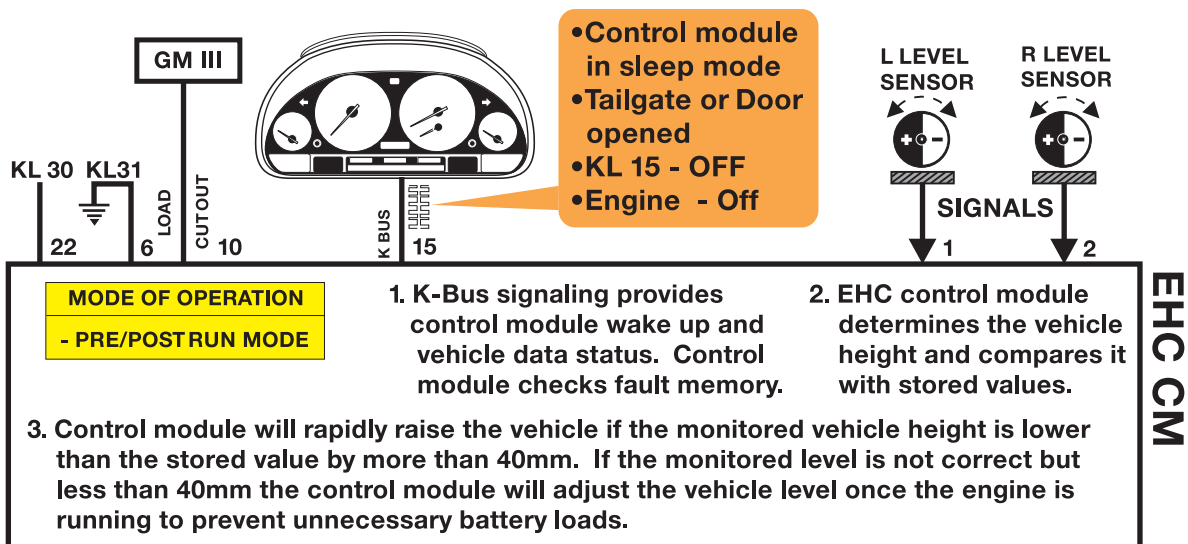
Two special operating modes are also included in the control module programming.

- **New/replacement mode** (pre ZCS encoded). This mode provides basic operation.
- **Transport Mode** - Transport mode is set at the factory and raises the vehicle 30mm to prevent vehicle damage during transportation. It must be deactivated with the DIS/MoDiC prior to customer delivery.

PRE-RUN/POST-RUN MODE

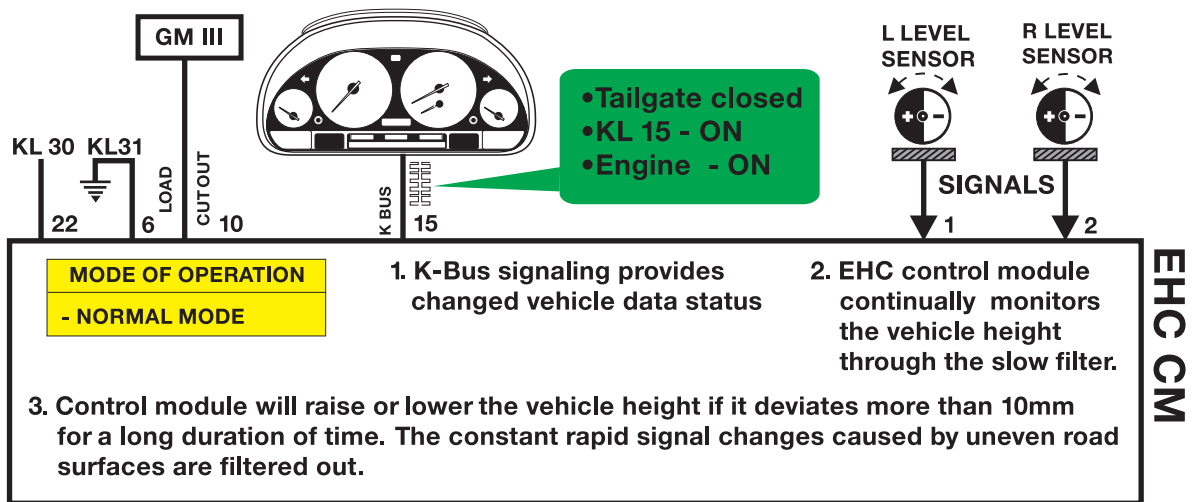
The Pre-Run mode is activated when the vehicle is parked and the control module is in the sleep mode. Opening a door or the tailgate initiates a system wake up and the control module comes on-line.

The control module performs a self-check of the control electronics and sensors. If no fault is found, the system will check the ride height and institute a rapid regulation if the height varies by more than 40mm.



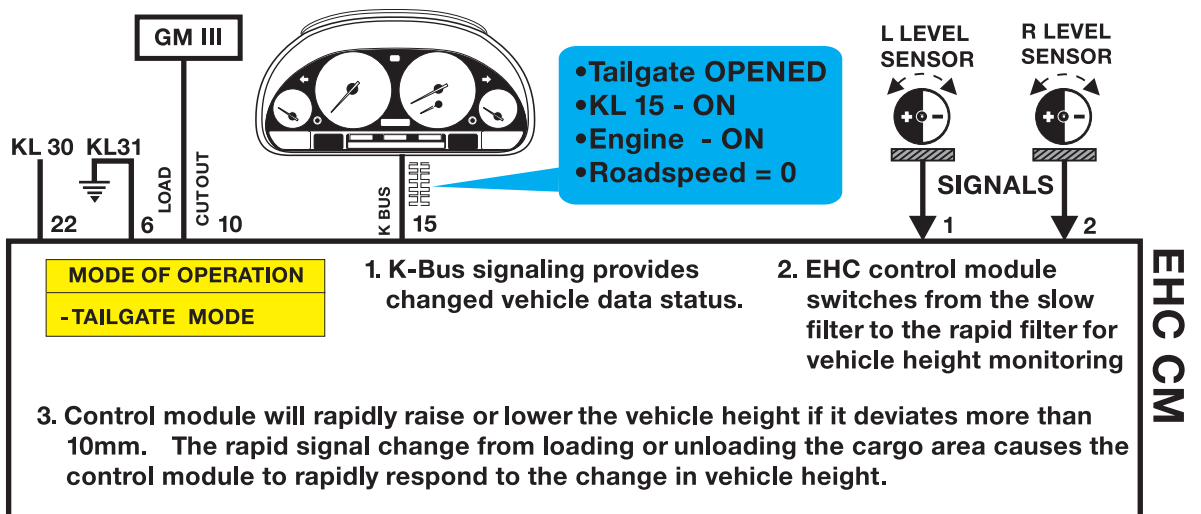
NORMAL MODE OPERATION

Once the rear lid is closed, KL 15 switched ON and the engine started, the system switches into the normal operation mode. In the normal mode, the control module will constantly monitor the input signals from the ride height sensors and will activate a correction if the ride height deviates by at least 10mm.



TAILGATE OPERATING MODE

The tailgate operating mode is activated if the gate is opened with KL - 15 On and the engine running. The difference between this mode and the normal operating mode is the response time is rapid instead of slow.



SPECIAL OPERATING MODES

- ASSEMBLY LINE MODE (New control module)

The assembly line mode refers to control module manufacturing. New control modules are stored in a deactivated state. The control programming is not active and must first be ZCS encoded.

After installing a replacement control module, it must be coded using the DIS or MoDiC. The instrument cluster fault display will remain illuminated until the control module is coded.

- TRANSPORT MODE

The vehicle rolls off the factory assembly line with the EHC control module in the transport mode. The transport mode inflates the air springs to a higher position (approx. 30mm higher) than the normal mode in order to avoid damage during transit.

The system will not respond to any inputs that would alter the height of the vehicle. The fault indicator (base cluster) is illuminated or instrument cluster matrix display (high cluster) provides the message "Leveling System" to draw attention to the transport mode setting.

The Service Functions section of the diagnosis program is used to activate/deactivate the transport mode. Once the transport mode is deactivated, check the vehicle Ride Height Offset making sure the vehicle rear axle height is to specification.

CONTROL INTERRUPTS

CORNERING

To prevent unnecessary suspension adjustments while driving through corners, a "control interrupt" is built into the system. Above 30MPH the control module monitors the left/right ride height sensors for a difference of 30mm. Exceeding this difference will put the system into a control interrupt and no adjustment will take place. The control interrupt last for a duration of 5 minutes.

VEHICLE LIFTING

The ride height control is interrupted when the vehicle is raised on a lift or with a jack. The system monitors the ride height sensor inputs and when the height limit of 90 mm is exceeded, the control is switched OFF until the vehicle is lowered again.

EHC SERVICE INFORMATION

DIAGNOSIS/CODING

- The EHC control module is connected to the diagnostic link. The EHC control module activates the fault display in the instrument cluster to alert the operator of the off-line status of the system. The EHC control module stores up to three electrical/electronic faults.
- Diagnosis/troubleshooting of EHC is carried out using the fault symptom troubleshooting program of the MoDiC or DIS. The EHC system has an extensive diagnosis program.
- Replacement control modules are shipped in the factory mode. The control modules must be ZCS encoded using the DIS or MoDiC to activate the operating parameters.

The image displays four screenshots of the BMW Diagnosis software interface, arranged in a 2x2 grid. Each screenshot shows a different diagnostic screen with a list of items and control buttons.

- Top Left: BMW Diagnosis FAULT SYMPTOMS**
 - Buttons: Print, Change, End, Services, Help
 - List:
 - 1 Fault display in instrument cluster
 - 2 Leakage in system
 - 3 Car positioned too high/too low on one/both side(s)
 - 4 Compressor running noise too loud
 - 5 Compressor does not start up, compressor runs continually or too often
 - 6 None of the fault symptoms indicated is applicable.
 - Question: Do you want to continue troubleshooting?
 - 1 Yes
 - 2 No
 - Buttons: Quick test, Note #
 - Bottom: Function selection, Document, Test Schedule, System
- Top Right: BMW Diagnosis TEST MODULES**
 - Buttons: Print, Change, End, Services, Help
 - List:
 - 1 Control unit
 - 2 Voltage and earth supply of control unit
 - 3 Height sensor, left
 - 4 Wire, height sensor, left
 - 5 Height sensor, right
 - 6 Wire, height sensor, right
 - 7 Wire, consumer-cutout signal
 - 8 X bus
 - 9 Air-supply system (LVA)
 - 10 Voltage and earth supply of air-supply system (LVA)
 - 11 Wire, drain valve
 - 12 Wire, compressor relay
 - 13 Wire, valve, left
 - 14 Wire, valve, right
 - 15 Compressor relay
 - 16 Pneumatic springs, air pipework, screw connections
 - Buttons: Quick test, Note #
 - Bottom: Function selection, Document, Test Schedule, System
- Bottom Left: BMW Diagnosis DIAGNOSIS REQUESTS**
 - Buttons: Print, Change, End, Services, Help
 - Text:
 - Ignition lock in position 2!
 - Terminal 15: ON
 - Engine status:OFF
 - Warning lamp/message:OFF
 - Journey detection:NO
 - Cornering: NO
 - Lifting platform/wheel change: YES
 - Inclination:NO
 - Node, end of assembly line:NO
 - Transportation mode:NO
 - Valve, rear right:OFF
 - Valve, rear left:OFF
 - Compressor relay:OFF
 - Drain valve:OFF
 - System voltages: Sensor supply: 5.0volts
 - Buttons: Quick test, Note #
 - Bottom: Function selection, Document, Test Schedule, System
- Bottom Right: BMW Diagnosis Mechanical components**
 - Buttons: Print, Change, End, Services, Help
 - Text:
 - Additional information:
 - Leaks in the screw joints between LVA, pneumatic lines or air spring strut can result in excessively long control times.
 - Possible effects of a leakage:
 - During a control process or the attempt to correct the car height for the purposes of height offset, the fault of control-time monitoring can be set.
 - Observe fault memory.
 - In this case, the compressor inside the LVA is deactivated so as to prevent overheating caused by excessive compressor running time. The LVA is able to respond only after an extended period of waiting.
 - Buttons: Quick test, Note #
 - Bottom: Function selection, Document, Test Schedule, System

DIS/MODIC SERVICE FUNCTIONS PROGRAM

The Service Functions program of the DIS/MoDiC provides the Transport Mode activation/deactivation and Ride Height Offset functions (see next page).

Once the transport mode has been released, or if the system requires left to right side height adjustment, the ride height "OFFSET" must be carried out to ensure that the vehicle's suspension has a base ride height level starting point.

The "HEIGHT OFFSET" is adjusted using the DIS or MoDiC. The procedure is as follows:

- Place the vehicle on a level surface unloaded.
- Access the Height Offset program in the service function menu.
- Measure the base ride height from the lower edge of the wheel housing to the center of the wheel hub.
- Check measured height against the specifications listed
- Use the DIS/MoDiC to correct the ride height if the value differs from the listed specification.

The image displays four screenshots of the BMW Diagnosis HEIGHT OFFSET program interface, arranged in a 2x2 grid. Each screenshot shows a different stage of the procedure.

Top-Left Screenshot: The main text area contains instructions: "Press the appropriate keys to move the car to the correct position (measurement with tape measure!). Each key actuation changes the car ride level by 5 to 10 mm. Dimensions apply from lower edge of wheel house to centre of wheel. Specified ride levels: E39 saloon : 360 mm +/- 3mm, E39 touring : 360 mm +/- 3mm, E39 touring with sports chassis : 345 mm +/- 3mm. Buttons at the bottom include "Function selection", "Document", "Test Schedule", and "System".

Top-Right Screenshot: The main text area contains "Additional information: Car must be in the normal position, i.e. in a compensated state. Car must be standing on a level surface. Instruction: One-sided loading and parking on uneven surfaces must be avoided! If necessary, wait until vehicle has corrected itself. Measure distance from lower edge of wheel house to wheel centre with tape measure. Specified ride levels: E39 saloon : 360 mm +/- 3mm, E39 touring : 360 mm +/- 3mm, E39 touring with sports chassis : 345 mm +/- 3mm. Buttons at the bottom include "Function selection", "Document", "Test Schedule", and "System".

Bottom-Left Screenshot: The main text area shows "sports chassis : 345 mm +/- 3mm" and a "Check: Is the vehicle height in the specified range?" section with radio buttons for "Yes" and "No". Buttons at the bottom include "Function selection", "Document", "Test Schedule", and "System".

Bottom-Right Screenshot: The main text area shows a list of options: "Left ▲", "Left ▼", "Right ▲", "Right ▼", and "Height O.K.". Buttons at the bottom include "Function selection", "Document", "Test Schedule", and "System".

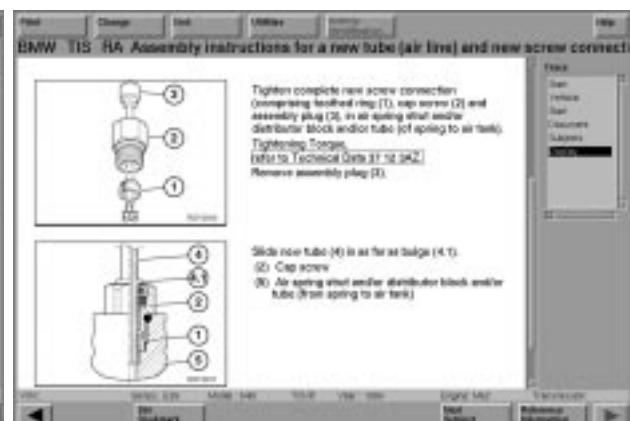
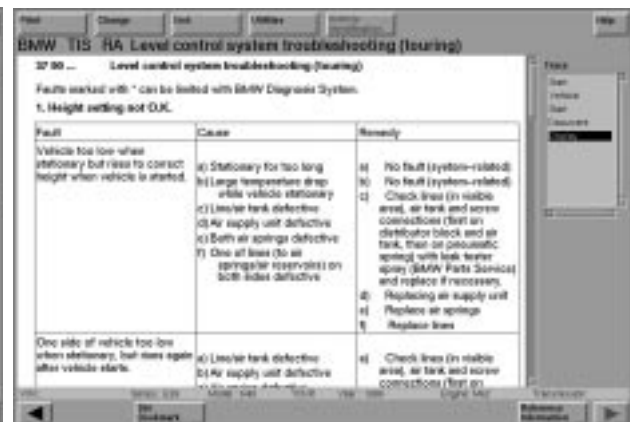
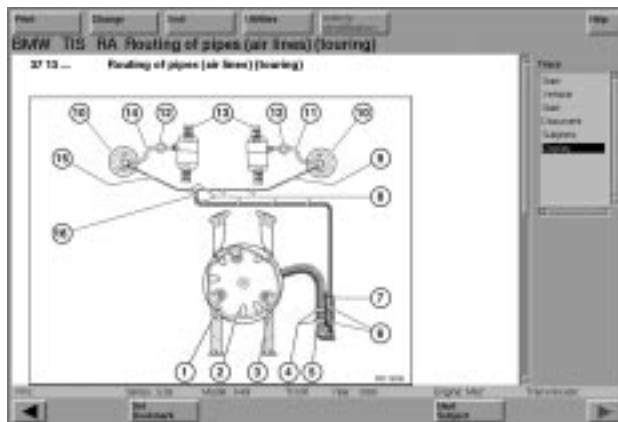
TIS REPAIR MANUAL INFORMATION

The repair manual contains the following EHC specific sub-group repair information:

- 00 General (general information, overview routing of pipes, tubes and lines) components)
- 12 Control and suspension system, rear (DIS referral, specific R&R procedures, etc.)
- 13 Connecting Lines (specific R&R procedures)
- 14 Electrical components (specific R&R procedures)
- 22 Pump assembly (LVA) with container (LVA R&R procedure)
- 90 Troubleshooting (system troubleshooting charts)

The troubleshooting charts provided an additional reference when used in conjunction with the DIS program.

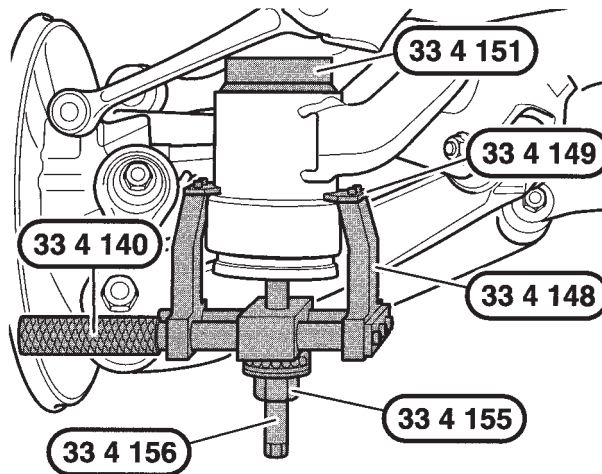
The following screen samples are from the TIS repair manual section.



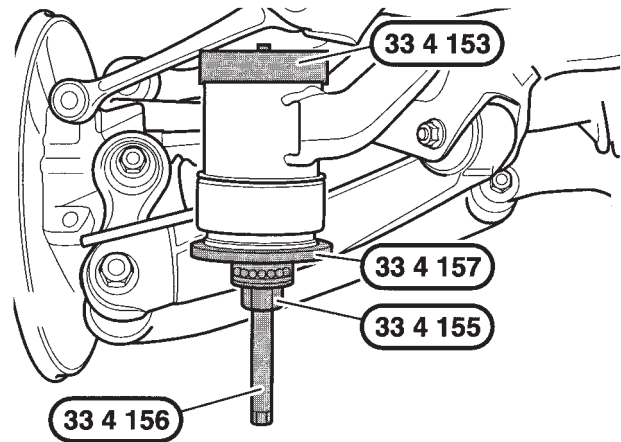
E39 SPORT WAGON SPECIAL TOOLS

HYDRO MOUNT R&R

Removal

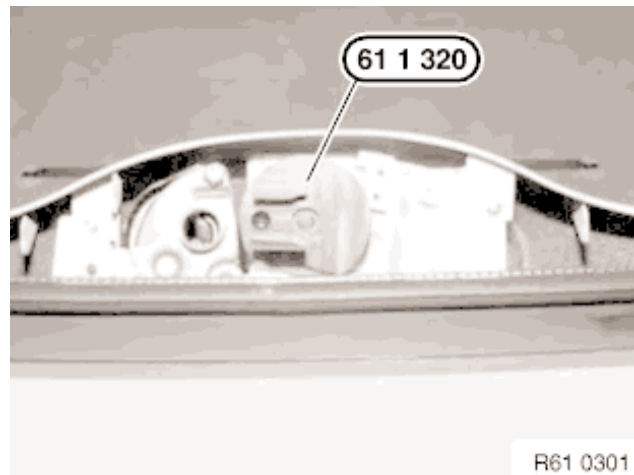
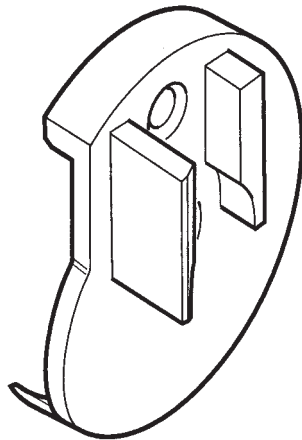


Replacement



WIPER ARM/DRIVE SHAFT ALIGNMENT TOOL

Holds the drive shaft in park position prior to installing the wiper arm on to the drive shaft.

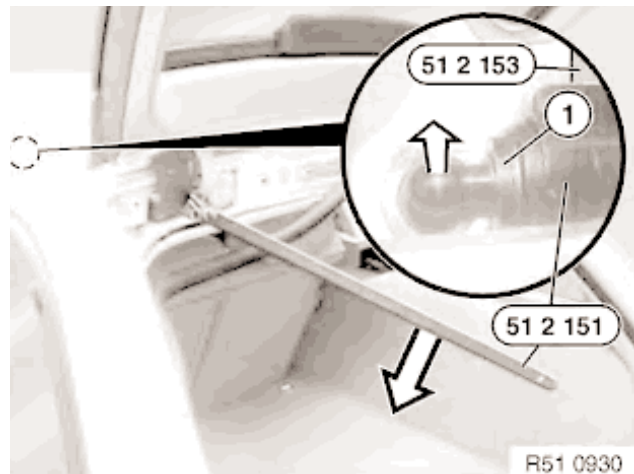
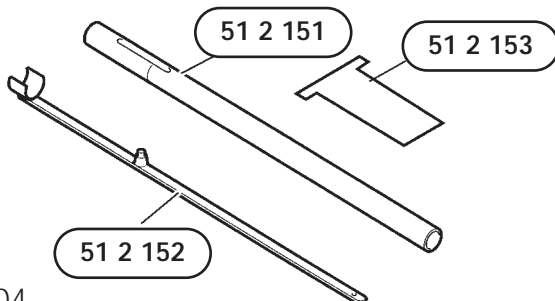


R61 0301

TAILGATE AND REAR WINDOW FRAME GAS LIFT SPRINGS

Tools for gas lift spring R&R. See page 105 for detailed cross sectional overviews.

- 51 2 151 - for tailgate gas lift spring
- 51 2 152 - for window frame gas lift spring



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TAILGATE/REAR WINDOW FRAME GAS LIFT SPRING DETAILS

Details provided for tailgate window frame gas lift springs. Tailgate gas lift springs follow same procedures for R&R. For complete information refer to TIS Repair Manual

